[DESCRIPTION]

[Title of Invention]

IMAGE CODING METHOD, IMAGE DECODING METHOD, IMAGE CODING APPARATUS, IMAGE DECODING APPARATUS, AND IMAGE CODING AND DECODING APPARATUS

[Technical Field]

[0001]

The present invention relates to image coding methods of coding an image on a per block basis and image decoding methods of decoding an image on a per block basis.

[Background Art]

[0002]

Non-Patent Literature (NPL) 1 discloses a technique relating to an image coding method of coding an image (including a moving picture) on a per block basis and an image decoding method of decoding an image on a per block basis.

[Citation List]

[Patent Literature]

[0003]

[NPL 1] ISO/IEC 14496-10 "MPEG-4 Part10 Advanced Video Coding"

[Summary of Invention]

[Technical Problem]

[0004]

However, some conventional image coding methods and image decoding methods include inefficient processes.

[0005]

Thus, embodiments of the present invention provides an image coding method of efficiently coding an image, and an image decoding method of efficiently decoding an image.

[Solution to Problem]

[0006]

~~The image coding method of coding an image on a per coding unit basis according to one embodiment of the present invention includes: applying a frequency transform to luminance data and chrominance data of transform units in the coding unit including~~

~~predetermined blocks each corresponding to one or more of the transform units; and coding the luminance data and the chrominance data to which the frequency transform has been applied to generate a bitstream in which the luminance data and the chrominance data are grouped on a per predetermined block basis.~~

According to a first aspect of the present invention, there is provided an image coding method of coding an image on a per coding unit basis, the method comprising: applying a frequency transform to luminance data and chrominance data of transform units in the coding unit including predetermined blocks each corresponding to one or more of the transform units; and coding the luminance data and the chrominance data to which the frequency transform has been applied to generate a bitstream in which the luminance data and the chrominance data are grouped on a per predetermined block basis. [0006a]

According to a second aspect of the present invention, there is provided an image coding apparatus which codes an image on a per coding unit basis, the image coding apparatus comprising: a frequency transform unit configured to apply a frequency transform to luminance data and chrominance data of transform units in the coding unit including predetermined blocks each corresponding to one or more of the transform units; and a coder which codes the luminance data and the chrominance data to which the frequency transform has been applied to generate a bitstream in which the luminance data and the chrominance data are grouped on a per predetermined block basis.

[0007]

These general and specific aspects may be implemented using a system, an apparatus, an integrated circuit, a computer program, or a non-transitory computer-readable recording medium such as a CD-ROM, or any combination of systems, apparatuses, methods, integrated circuits, computer programs, or computer-readable recording media.

[Advantageous Effects of Invention]

[0008]

The image coding method and the image decoding method according to embodiments of the present invention provide a method of efficiently coding or decoding an image.

[Brief Description of Drawings]

[0009]

[FIG. 1]

FIG. 1 illustrates a conventional bitstream.

[FIG. 2]

FIG. 2 is a block diagram illustrating a configuration of the image coding apparatus according to the first embodiment.

[FIG. 3]

FIG. 3 illustrates the bitstream according to the first embodiment.

[FIG. 4]

FIG. 4 is a flow chart illustrating the coding operation according to the first embodiment.

[FIG. 5]

FIG. 5 illustrates the bitstream according to a variation of the first embodiment.

[FIG. 6]

FIG. 6 is a flow chart illustrating the coding operation

[CLAIMS]

[Claim 1]

An image coding method of coding an image on a per coding unit basis, the method comprising:

applying a frequency transform to luminance data and chrominance data of transform units in the coding unit including predetermined blocks each corresponding to one or more of the transform units; and

coding the luminance data and the chrominance data to which the frequency transform has been applied to generate a bitstream in which the luminance data and the chrominance data are grouped on a per predetermined block basis.

[Claim 2]

The image coding method according to Claim 1,

wherein each of the predetermined blocks corresponds to transform units in a block of a predetermined size, or to a transform unit of a size greater than or equal to the predetermined size, and

in the coding, the luminance data and the chrominance data are coded to generate the bitstream in which the luminance data and the chrominance data are grouped on a per predetermined block basis.

[Claim 3]

The image coding method according to Claim 1 or 2,

wherein in the applying:

the frequency transform is applied to the luminance data on a per transform unit basis;

when a total number of pixels of the chrominance data and a total number of pixels of the luminance data are equal, the frequency transform is applied to the chrominance data on a per transform unit basis; and

when the total number of pixels of the chrominance data is less than the total number of pixels of the luminance data, the frequency transform is applied to the chrominance data on a per predetermined

block basis.

[Claim 4]

The image coding method according to any one of Claims 1 to 3,

wherein in the applying, from among the chrominance data of the transform units in the coding unit, chrominance data of transform units in a block of a size that is smaller than or equal to the predetermined size is combined, and the frequency transform is applied to the combined chrominance data in one frequency transform.

[Claim 5]

The image coding method according to any one of Claims 1 to 4,

wherein in the applying, when a size of one of the transform units is a predetermined smallest size and in the transform unit a total number of pixels of chrominance data is less than a total number of pixels of luminance data, from among the chrominance data of the transform units in the coding unit, chrominance data of transform units in a block including the transform unit is combined, and the frequency transform is applied to the combined chrominance data in one frequency transform.

[Claim 6]

The image coding method according to any one of Claims 1 to 5,

wherein in the coding, luminance data and chrominance data of transform units in one of the predetermined blocks are coded to generate the bitstream in which, in the predetermined block, the chrominance data of all the transform units follows the luminance data of all the transform units.

[Claim 7]

The image coding method according to Claim 1 or 2,

wherein each of the predetermined blocks corresponds to transform units in a block of a predetermined size, or to a transform unit of a size greater than or equal to the predetermined size,

in the applying, the frequency transform is applied to the luminance data and the chrominance data on a per transform unit basis, and

in the coding, the luminance data and the chrominance data are coded to generate the bitstream in which the luminance data and the chrominance data are grouped on a per predetermined block basis.

[Claim 8]

The image coding method according to Claim 1,

wherein each of the predetermined blocks corresponds to a different one of the transform units,

in the applying, the frequency transform is applied to the luminance data and the chrominance data on a per transform unit basis, and

in the coding, the luminance data and the chrominance data are coded to generate the bitstream in which the luminance data and the chrominance data are grouped on a per transform unit basis.

[Claim 9]

An image decoding method of decoding an image on a per coding unit basis, the method comprising:

decoding luminance data and chrominance data of transform units in the coding unit including predetermined blocks each corresponding to one or more of the transform units, the decoding including obtaining a bitstream, and the luminance data and the chrominance data being data to which a frequency transform has been applied and which has been coded and grouped in the bitstream on a per predetermined block basis; and

applying an inverse frequency transform to the decoded luminance data and the decoded chrominance data.

[Claim 10]

The image decoding method according to Claim 9,

wherein each of the predetermined blocks corresponds to transform units in a block of a predetermined size, or to a transform unit of a size greater than or equal to the predetermined size, and

in the decoding, the bitstream in which the luminance data and the chrominance data are grouped on a per predetermined block basis is obtained, and the luminance data and the chrominance data are decoded.

[Claim 11]

The image decoding method according to Claim 9 or 10,

wherein in the applying:

the inverse frequency transform is applied to the luminance data on a per transform unit basis;

when a total number of pixels of the chrominance data and a total number of pixels of the luminance data are equal, the inverse frequency transform is applied to the chrominance data on a per transform unit basis; and

when the total number of pixels of the chrominance data is less than the total number of pixels of the luminance data, the inverse frequency transform is applied to the chrominance data on a per predetermined block basis.

[Claim 12]

The image decoding method according to any one of Claims 9 to 11,

wherein in the applying, the inverse frequency transform is applied to, from among the chrominance data of the transform units in the coding unit, chrominance data of transform units in a block of a size that is smaller than or equal to the predetermined size in one inverse frequency transform.

[Claim 13]

The image decoding method according to any one of Claims 9

to 12,

wherein in the applying, when a size of one of the transform units is a predetermined smallest size and in the transform unit a total number of pixels of the chrominance data is less than a total number of pixels of the luminance data, the inverse frequency transform is applied to, from among the chrominance data of the transform units in the coding unit, chrominance data of transform units in a block including the transform unit in one inverse frequency transform.

[Claim 14]

The image decoding method according to any one of Claims 9 to 13,

wherein in the decoding, the bitstream is obtained in which, in one of the predetermined blocks, chrominance data of all transform units follows luminance data of all the transform units, and the luminance data and the chrominance data of the transform units in the predetermined block are decoded.

[Claim 15]

The image decoding method according to Claim 9 or 10,

wherein each of the predetermined blocks corresponds to transform units in a block of a predetermined size, or to a transform unit of a size greater than or equal to the predetermined size,

in the decoding, the bitstream in which the luminance data and the chrominance data are grouped on a per predetermined block basis is obtained, and the luminance data and the chrominance data are decoded, and

in the applying, the inverse frequency transform is applied to the luminance data and the chrominance data on a per transform unit basis.

[Claim 16]

The image decoding method according to Claim 9,

wherein each of the predetermined blocks corresponds to a

different one of the transform units,

in the decoding, the bitstream in which the luminance data and the chrominance data are grouped on a per transform unit basis is obtained, and the luminance data and the chrominance data are decoded, and

in the applying, the inverse frequency transform is applied to the luminance data and the chrominance data on a per transform unit basis.

[Claim 17]

An image coding apparatus which codes an image on a per coding unit basis, the image coding apparatus comprising:

a frequency transform unit configured to apply a frequency transform to luminance data and chrominance data of transform units in the coding unit including predetermined blocks each corresponding to one or more of the transform units; and

a coder which codes the luminance data and the chrominance data to which the frequency transform has been applied to generate a bitstream in which the luminance data and the chrominance data are grouped on a per predetermined block basis.

[Claim 18]

An image decoding apparatus which decodes an image on a per coding unit basis, the image decoding apparatus comprising:

a decoder which (i) obtains a bitstream in which frequency transformed and coded luminance data and chrominance data are grouped on a per predetermined block basis, and (ii) decodes the luminance data and the chrominance data of transform units in the coding unit including predetermined blocks each corresponding to one or more of the transform units; and

an inverse frequency transform unit configured to apply an inverse frequency transform to the decoded luminance data and the decoded chrominance data.

[Claim 19]

An image coding and decoding apparatus comprising:

an image coding apparatus which codes an image on a per coding unit basis; and

an image decoding apparatus which decodes an image a per coding unit basis,

wherein the image coding apparatus includes:

a frequency transform unit configured to apply a frequency transform to luminance data and chrominance data of transform units in the coding unit including predetermined blocks each corresponding to one or more of the transform units; and

a coder which codes the luminance data and the chrominance data to which the frequency transform has been applied to generate a bitstream in which the luminance data and the chrominance data are grouped on a per predetermined block basis, and

the image decoding apparatus includes:

a decoder which (i) obtains a bitstream in which frequency transformed and coded luminance data and chrominance data are grouped on a per predetermined block basis, and (ii) decodes the luminance data and the chrominance data of transform units in the coding unit including predetermined blocks each corresponding to one or more of the transform units; and

an inverse frequency transform unit configured to apply an inverse frequency transform to the decoded luminance data and the decoded chrominance data.

CLAIMS

1. An image coding method of coding an image on a per coding unit basis, the method comprising:

applying a frequency transform to luminance data and chrominance data of transform units in the coding unit including predetermined blocks each corresponding to one or more of the transform units; and

coding the luminance data and the chrominance data to which the frequency transform has been applied to generate a bitstream in which the luminance data and the chrominance data are grouped on a per predetermined block basis.

2. An image coding apparatus which codes an image on a per coding unit basis, the image coding apparatus comprising:

a frequency transform unit configured to apply a frequency transform to luminance data and chrominance data of transform units in the coding unit including predetermined blocks each corresponding to one or more of the transform units; and

a coder which codes the luminance data and the chrominance data to which the frequency transform has been applied to generate a bitstream in which the luminance data and the chrominance data are grouped on a per predetermined block basis.